

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Niels EMME  
Serial No.: New Application  
Filed: December 31, 2001  
For: MOBILE TERMINAL WITH DIGITAL CAMERA AND METHOD  
OF CAPTURING IMAGES

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

December 31, 2001

Sir:

The following preliminary amendments and remarks are respectfully  
submitted in connection with the above-identified application.

**IN THE SPECIFICATION:**

Please replace the original specification with the attached Substitute  
Specification.

**IN THE CLAIMS:**

Please cancel claims 1-18 without prejudice or disclaimer and add the  
following new claims:

19. A mobile communication terminal comprising:  
a digital camera having an angle of view, the mobile communication terminal further comprising a source of infrared light for emitting a beam of infrared light, whereby the angle of view and the infrared light beam are directed such that a substantial part of the angle of view is overlapped by the infrared light beam so that objects in the angle of view may be illuminated by the infrared light beam.
20. A mobile communication terminal according to claim 19, wherein:  
the source of infrared light is movable and the direction of the infrared light beam is substantially aligned with the angle of view.
21. A mobile communication terminal according to claim 19, comprising:  
an infrared filter that can be moved in and out of the light path into the camera.
22. A mobile communication terminal according to claim 21, wherein:  
the infrared filter has a first position in the light path and a second position out of the light path.
23. A mobile communication terminal according to claim 22, comprising:  
an electro-mechanical or electronic actuator which moves the infrared filter from the first position to the second position and back.
24. A mobile communication terminal according to claim 19, comprising:  
a display, which displays the image captured by the camera.

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Variable	Mean	SD	Min	Max
Age	34.2	10.5	21	55
Gender	50.0	0.0	0	1
Marital status	50.0	0.0	0	1
Education	12.5	1.5	9	16
Income	15.0	5.0	10	25
Occupation	1.5	1.0	0	2
Health status	1.5	1.0	0	2
Life satisfaction	4.5	1.5	1	7
Life expectancy	75.0	5.0	60	90
Life expectancy squared	5625.0	250.0	3600	8100
Life expectancy cubed	421875.0	15625.0	216000	729000
Life expectancy to the fourth power	31640625.0	1562500.0	12960000	28242950
Life expectancy to the fifth power	2378531250.0	156250000.0	677640000	2430000000
Life expectancy to the sixth power	178593750000.0	15625000000.0	46656000000	177147000000
Life expectancy to the seventh power	13400625000000.0	1562500000000.0	3481600000000	12800880000000
Life expectancy to the eighth power	1015062500000000.0	156250000000000.0	268435200000000	984205300000000
Life expectancy to the ninth power	76171875000000000.0	15625000000000000.0	20132659200000000	74436817000000000
Life expectancy to the tenth power	5712656250000000000.0	156250000000000000.0	151178944000000000	5488182400000000000
Life expectancy to the eleventh power	42843750000000000000.0	1562500000000000000.0	1117209600000000000	41762643200000000000
Life expectancy to the twelfth power	324000000000000000000.0	15625000000000000000.0	8589952000000000000	31601856000000000000
Life expectancy to the thirteenth power	2430000000000000000000.0	156250000000000000000.0	64719360000000000000	238934400000000000000
Life expectancy to the fourteenth power	18187500000000000000000.0	1562500000000000000000.0	498150400000000000000	18266880000000000000000
Life expectancy to the fifteenth power	136406250000000000000000.0	15625000000000000000000.0	35852160000000000000000	132018560000000000000000
Life expectancy to the sixteenth power	1015062500000000000000000.0	156250000000000000000000.0	268435200000000000000000	984205300000000000000000
Life expectancy to the seventeenth power	7617187500000000000000000.0	1562500000000000000000000.0	1971609600000000000000000	7243681700000000000000000
Life expectancy to the eighteenth power	57126562500000000000000000.0	15625000000000000000000000.0	14685040000000000000000000	54881824000000000000000000
Life expectancy to the nineteenth power	428437500000000000000000000.0	156250000000000000000000000.0	111720960000000000000000000	417626432000000000000000000
Life expectancy to the twentieth power	3240000000000000000000000000.0	1562500000000000000000000000.0	858995200000000000000000000	3160185600000000000000000000
Life expectancy to the twenty-first power	24300000000000000000000000000.0	15625000000000000000000000000.0	6471936000000000000000000000	23893440000000000000000000000
Life expectancy to the twenty-second power	181875000000000000000000000000.0	156250000000000000000000000000.0	498150400000000000000000000000	1826688000000000000000000000000
Life expectancy to the twenty-third power	1364062500000000000000000000000.0	1562500000000000000000000000000.0	3585216000000000000000000000000	13201856000000000000000000000000
Life expectancy to the twenty-fourth power	10150625000000000000000000000000.0	15625000000000000000000000000000.0	26843520000000000000000000000000	98420530000000000000000000000000
Life expectancy to the twenty-fifth power	76171875000000000000000000000000.0	156250000000000000000000000000000.0	197160960000000000000000000000000	724368170000000000000000000000000
Life expectancy to the twenty-sixth power	571265625000000000000000000000000.0	1562500000000000000000000000000000.0	1468504000000000000000000000000000	5488182400000000000000000000000000
Life expectancy to the twenty-seventh power	4284375000000000000000000000000000.0	15625000000000000000000000000000000.0	11172096000000000000000000000000000	41762643200000000000000000000000000
Life expectancy to the twenty-eighth power	32400000000000000000000000000000000.0	156250000000000000000000000000000000.0	858995200000	

32. A mobile communication terminal according to claim 31, comprising:  
an actuator which moves the lens cover from the first position to the second position and back.

33. A mobile communication terminal according to claim 31, comprising a handle having a first position associated with the first position of the lens cover, the handle having a second position associated with the second position of the lens cover and the first position of the infrared filter, and the handle having a third position associated with the second position of the infrared filter.

34. A method of capturing infrared images comprising the steps of:  
providing a mobile communication terminal comprising a digital camera and an infrared port; and  
illuminating objects to be captured with infrared light emitted by the infrared port.

35. A method according to claim 34, comprising the step of:  
arranging the digital camera and the source of infrared light in substantially a same direction on the mobile communication terminal.

36. Method according to claim 34, further comprising the steps of:  
providing an infrared filter used when capturing images with visible light, and

removing the infrared filter from the light path into the camera when capturing infrared images.

37. Method according to claim 35, further comprising the steps of:  
providing an infrared filter used when capturing images with visible light, and  
removing the infrared filter from the light path into the camera when capturing infrared images.

38. A method according to claim 34, wherein:  
the camera comprises an auto focus system and further comprising the step of adjusting settings of the auto focus system to characteristics of the infrared light when capturing infrared images.

39. A method according to claim 34, wherein:  
the mobile communication terminal comprises a display and further comprising the step of displaying images captured by the digital camera on the display.

40. A method according to claim 39, comprising the step of:  
capturing and displaying the images at intervals, permitting the mobile communication terminal to be used as a night vision device.

**IN THE ABSTRACT OF THE DISCLOSURE:**

Please amend the abstract as follows or, if abstract is more than one paragraph, use: Please replace the abstract with the following new abstract:

## REMARKS

Applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. The substitute specification includes the changes as shown in the marked-up copy and includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The claims have been amended to remove multiple dependent claims for fee calculation purposes and to improve the form of the claims for examination.

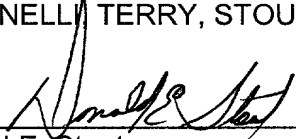
The abstract has been amended to provide an abstract in proper format.

Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (1149.41056X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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# MOBILE TERMINAL WITH DIGITAL CAMERA AND METHOD OF CAPTURING IMAGES

*BACKGROUND OF THE INVENTION*  
*Field of the Invention*

The present invention relates to mobile communication terminals, in particular mobile communication terminals *[Terminals]* that comprise a source of infrared light, such as an infrared port and a digital camera.

## BACKGROUND ART

*Description of the Prior Art*

<sup>patent</sup>  
US ~~A~~<sup>J</sup> 6,031,825 discloses a system for providing an infra red link between a mobile phone and its accessories. The mobile phone is provided with an infrared transceiver comprising an infrared receiver and an infrared LED. The infrared port provides for a wireless connection between the phone and its accessories, such as a personal computer, a printer, or another phone to transmit data, audio, control and logical signals between them.

Recently, mobile phones have been equipped with digital cameras. EP-A-0 898 405 discloses a mobile phone provided with a digital camera and an infrared port. The mobile phone has an upper case and a lower case connected by a connection part. The infrared port and the digital camera are both arranged in a connection part, facing opposite directions. The camera can capture images using visible light.

Charged Coupled Devices (CCDs) that are used in commercially available digital cameras are sensitive both to light in the visible spectrum and in the near infrared spectrum. These digital cameras are therefore provided with infrared filters so that interference by any infrared light entering the camera is avoided.

## SUMMARY DISCLOSURE OF THE INVENTION

The availability of infrared light and the inherent sensitivity of CCDs to infrared light offers an hereto unrealized potential to use communication terminals equipped with an infra red port and a digital camera to capture infrared images. On this background, *[it is an object of]* the present invention *to provide* a mobile phone of the kind *[referred to initially]* which can be used to capture infrared images. *[This object is achieved in accordance with claim 1 by providing a]* mobile communication terminal comprising a digital camera having an angle of view, the mobile communication terminal further

*in accordance with the invention*

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comprising a source of infrared light for emitting a beam of infrared light, whereby the angle of view and the infrared light beam are directed such that a substantial part of the angle of view is overlapped by the infrared light beam so that objects in the angle of view may be illuminated by the infrared light beam.

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The source of infrared light may be movable so that the direction of the infrared light beam can be substantially aligned with the angle of view.

10 The mobile communication terminal may further comprise an infrared filter that can be moved in and out of the light path into <sup>th</sup>said camera.

The mobile communication terminal may be provided with an infrared filter that has a first position in <sup>th</sup>said light path and a second position out of <sup>th</sup>said light path.

15 The mobile communication terminal may comprise electro mechanical or electronic means to move <sup>th</sup>said infrared filter from <sup>th</sup>said first position to <sup>th</sup>said second position and back.

20 The mobile communication terminal may comprise a display, for displaying images captured by <sup>th</sup>said camera. The images captured by the camera may be refreshed at regular intervals.

25 In a preferred embodiment at least 60% of the viewing angle is overlapped by the infrared light beam, preferably at least 80 % of the viewing angle is overlapped by the infrared light beam, and even more preferable at least 90% of the viewing angle is overlapped by the infrared light beam.

The mobile communication terminal may be provided with software for processing captured digital images.

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The mobile communication terminal may comprise <sup>a focusing system</sup>means for focusing the light coming into <sup>th</sup>said camera, whereby <sup>th</sup>said <sup>th</sup>focusing <sup>th</sup>means <sup>th</sup>for focusing <sup>th</sup>have a first setting adjusted to the characteristics of visual light and a second setting adjusted to the characteristics of infrared light. <sup>system</sup>

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The mobile communication terminal may comprise a lens cover, having a first position covering the lens of <sup>th</sup>said camera and a second position exposing <sup>th</sup>said lens, <sup>an actuator which</sup>said mobile communication terminal preferably further comprising <sup>means of actuating</sup>said lens cover from the first position to the second position and back.

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The mobile communication terminal may comprise a handle having a first position associated with <sup>th</sup>said first position of <sup>th</sup>said lens cover, <sup>th</sup>said handle having a second position associated with <sup>th</sup>said second position of <sup>th</sup>said lens cover and <sup>th</sup>said first position of <sup>th</sup>said infrared filter, and <sup>th</sup>said handle having a third position associated with <sup>th</sup>said

10 second position of said infrared filter

<sup>It</sup>It is a further object of <sup>the</sup>the present invention <sup>further is</sup>to provide a method for capturing infrared images with a mobile communication terminal equipped with a digital camera and an infrared port. <sup>This</sup>This object is achieved in accordance with claim 13, by providing <sup>The</sup>a method of capturing infrared images comprising <sup>es</sup>the steps of,

- providing a mobile communication terminal comprising a digital camera and an infrared port, and
- illuminating objects to be captured with the infrared light emitted by the infrared port.

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20 Preferably, the method further comprises the step of arranging the digital camera and the source of infra red light substantially in the same direction on the mobile communication terminal.

The method may further comprise the step of providing an infrared filter for use when capturing images with visible light, and comprising the step of removing <sup>th</sup>said infrared filter from the light path into the camera when capturing infrared images.

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When <sup>th</sup>said camera comprises an auto focus system, the method may further comprise the step of adjusting the settings of the auto focus system to the characteristics of infrared light when capturing infrared images.

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When <sup>th</sup>said mobile communication terminal comprises a display, the method may further comprise the step of displaying images captured by the digital camera on the display.

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The method may further comprise the step of capturing <sup>A</sup>said images at short intervals thus, allowing the mobile communication terminal to be used as a night vision device.

Further objects, features, advantages and properties of the bearing, shell and production methods according to the invention will become apparent from the detailed description.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the following detailed portion of the present description, the invention will be explained in more detail with reference to the exemplary embodiments shown in the drawings, in which

Fig. 1 shows in a perspective view the front of an embodiment of a communication terminal according to the invention,

Fig. 2 shows in a perspective view the rear of an embodiment of a communication terminal according to the invention with the lens exposed,

Fig. 2a shows in a perspective view the rear of an embodiment of a communication terminal according to the invention with the lens covered, and

Fig. 3 shows an embodiment of a mechanism for controlling the position of a cover for the camera module and for controlling the position of an infrared filter.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Figs. 1 and 2 a mobile communication terminal according to the invention in the form of a hand portable phone 1, preferably a cellular/ mobile phone, provided with a camera <sup>1S</sup>will be described. The phone 1 <sup>1S</sup>provided with a front cover 2 having a window frame 3 encircling the protection window of the display assembly. The phone comprises a user interface having an on/off button 4, a speaker 5 (only the openings are shown), a keypad 7, an LCD display 6 and a microphone (not shown). The LCD display may be a high resolution TFT matrix display for displaying high-resolution color pictures. The phone 1 further comprises a battery pack 11. The keypad comprises a first group of alphanumeric keys 8, two multi-function keys 9 (so-called soft keys), two call handling keys 12, and a scroll key 19. The functionality of the keys and the user interface is well known and not explained in detail here.

The mobile phone is provided with an infrared port 60. The infrared port is as such conventional and therefore not all features described here are shown in the drawings. The infrared port comprises a cover 60 that is transparent to infrared light. An infrared transceiver is arranged under the cover 60. Commercially available infrared transceivers may be used in this application. The infrared transceiver comprises a

The LED emits a beam of infrared light through the cover 60 in a direction that is substantially perpendicular to the rear surface 33 of the mobile phone. The infrared port provides for a wireless connection between the phone 1 and its accessories, such as a personal computer, a printer, or another phone to transmit data, audio, control and logical signals between them. The general term "infrared light" as used here includes light with a wavelength of 770 to 1000  $\mu\text{m}$ . Infrared transceivers as used for infrared ports on mobile phones operate typically with a wavelength of 850-900  $\mu\text{m}$ .

The camera in the mobile phone is a conventional digital camera and therefore not all the features of the camera are shown. The camera uses one or more Charge Coupled Devices (CCDs) (not shown) for capturing images. The camera is further provided with a lens 36 and an auto focus system (not shown). A lens cover 42 protects the lens 36 and the camera from dust, direct sunlight and mechanical contact when the camera is turned off. The lens cover 42 is a slide cover that makes a sliding movement between a camera non-operating position, in which it covers at least the lens 36 and a camera operating position at which the lens is exposed. The camera is arranged at the rear of the mobile phone in the battery pack 11. The camera direction is therefore substantially perpendicular the to the rear surface 33 of the mobile phone 1. The camera has thus an angle of view directed away from the rear surface 33 of the mobile phone 1.

Standard CCD devices are sensitive to both visual light and near infrared light. Conventional digital cameras for capturing images with visual light are therefore provided with an infrared filter for preventing influences of infrared light on the captured image. The mobile phone 1 is also provided with an infrared filter 43. The infrared filter 43 can though be moved out of the path of the light into the camera for capturing infrared images.

The lens 36 is preferably a fixed focal length lens with <sup>a</sup>movable lens group to allow auto focus, however, lens 36 could be any plurality of lens providing for adjustment to focus on different parts of the image received, as will be understood to those skilled in the art. The characteristics of visible light and near infrared light with respect to focusing are slightly different. Therefore, the auto focus system has two settings; a first setting for capturing images with visual light and a second setting for infrared light.

A standard software for processing, storing and recalling pictures captured with visual light and captured with infrared light is installed on the phone 1. This software may as such be conventional and commercially available. The software is also able to control the refresh rate of the images shown on the display and the refresh rate of the captured images.

A mechanism for moving the lens cover 42 is described with reference to Figs. 3a to 3c. The mechanism comprises a wheel 40, a lens cover 42 and a connection between the wheel 40 and the lens cover 42. The connection consists of a first link 46 and a second link 44 being connected in a joint 48. The first link 46 is attached to the lens cover 42 via a pivot point 45. The first link 47 is connected to the wheel 40 by a pivot point 47. The mechanism can move the lens cover 42 from a first, closed position to a second position and vice versa. An infrared filter 43 is connected to the lens cover 42 and moves integrally with the lens cover 42. In the second position of the lens cover 42, the infrared filter 43 is in the path of the light falling into the camera (Fig 3b). There could of course be only one link or more than two links in the connection between the cover 42 and the wheel 40. The described mechanism has been simplified in that it does not include bearing, guiding elements, etc. to just show the essential parts of the mechanism. The wheel may be driven by an electrical actuator such as an electric motor or an electromagnetic actuator (not shown) or by a mechanical actuator such as a handle 49. As the wheel 40 is rotated, the link mechanism 45,46, will translate the rotating motion of the wheel 40 into a linear motion 53 of the lens cover 42 and the infrared filter 43. In <sup>Fig.</sup>figure 3a, the lens cover is in its first position where it covers and protects the camera lens 36 (not shown in ~~figure 3a~~ <sup>Fig.</sup>figure 3a). The infrared filter 43 is in a parked position where it has no direct function. To move the lens cover 42 from its closed position, to its second position, and the infrared filter 43 from its parked position to its first position, the position in which the infrared filter 43 is in the light path into the camera, the wheel 40 is rotated in a

clockwise direction 51 to move the pivot point 47 substantially above the center of the wheel as shown in Fig. 3b. When the lens cover 42 is moved to its second position, the open position, and the infrared filter 43 is moved to its first position, the camera lens 36 is exposed to the visible light, and the camera can be used to capture images with visible light. To move the lens cover back to its first position, the wheel 40 is rotated anticlockwise (not shown).

To move the infrared filter 43 to its second position, where it is not in the light path into the camera, the wheel 40 is rotated further in a clockwise direction 51 to move the pivot point 47 to be located to the right from the center of rotation as shown in Fig. 3c. The lens cover 42 is now in its third position, which is also an open position, and the infrared filter is in its second position, in which it is not in the light path into the camera. The lens is now also exposed to infrared light, and can be used to capture images with infrared light. In this position of the infrared filter, the infrared LED of the infrared port can be activated. The angle of view of the camera and the light beam emitted by the infrared LED are aimed in substantially the same direction. There is thus a substantial overlap of the angle of view and the infrared light beam so that objects in the angle of view of the camera are illuminated by the infrared light beam.

The infrared light beam overlaps preferably more than 60% of the angle of view and even more preferable more than 80% of the angle of view is overlapped by the infrared light beam. Thus, when the camera is aimed at an object to be photographed, the light emitted by the infrared LED <sup>is</sup> will also ~~be~~ directed to the object to be photographed which <sup>is</sup> will be illuminated with infrared light to enhance light intensity at which infrared images <sup>are</sup> can be captured.

In another embodiment (not shown) the infrared port may also be arranged movable with respect to the mobile phone 1. Thus, the direction of the light beam emitted by the infrared LED can be directed towards an object to be illuminated.

The camera may be provided with further filters (not shown) such as ultraviolet filters, optical low and high pass filters of various wavelengths of visible light as known to those skilled in the art. Those skilled in the art will realize other filter may be used. The image sensor may comprise any of the known configurations for solid-state image sensors, such as frame transfer, interline transfer CCDs, or diode arrays.

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ABSTRACTMOBILE TERMINAL WITH DIGITAL CAMERA AND METHOD OF CAPTURING IMAGES

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The invention relates to a mobile communication terminal provided with a digital camera and an infrared port. The digital camera and the infrared port are arranged such that the infrared light emitted by the infrared port can be used to capture images with infrared light.

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~~It is suggested that Fig. 2 is published with the abstract.~~

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